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PRESIDENTIAL ADDRESS

DAVID S. HILL, PH. D., LL. D., The State University Albuquerque.

The Scientific Classification of School Children

Classifications, although necessary for administrative purposes, nevertheless are arbitrary and tentative The problems of mass-education were emphasized by the early attempts of Lancaster and of Bell. We observe today four types of groupings, namely:

1. **By Age.** Chronological, anatomical, physiological, and psychological aspects of the problem of grouping by ages, are recognized.

2. **By Schools.** Kindergarten, Primary, Grammar, Intermediate and Junior High, Special, Parental, Normal Schools, Junior Colleges, Colleges and Universities, Professional Schools—respectively are supposed to care separately for different types of groups, but actually with much duplication.

3. **By Age-Grade.** The persistent fallacy of classifying over-age children in grades, as RETARDED, persists. The true classification is ninefold, namely:
At Age, with slow, or rapid, or normal progress.
Over-Age, with slow, or rapid, or normal progress.
Under-Age, with slow, or rapid, or normal progress.

4. **The Exceptional.** The exceptional child is one who exhibits an extreme individual variation from the average of his kind. For convenience of classification substantially the following groupings were found useful in extensive studies involving a consideration of about 100,000 pupils in Philadelphia and New Orleans. That is—

1. The Bright.
2. The Dull.
3. Feeble-minded—The Aments.
4. Sufferers from Dementia.
5. Habitually Vicious.
6. Physically Defective, as
    - Blind,
    - Deaf,
    - Crippled,
    - Epileptic,
    - Tubercular.

In conclusion, the necessity for (a) well-trained teachers and superintendents, (b) organized co-operative studies of these problems, and (c) for conservative application of known preventive and remedial measures, is indicated.

THE ABLAUT SYSTEMS OF DL:DEL:DOL AND SUP:SUEP':SUOP.

L. B. MITCHELL, Ph.D., State University, Albuquerque.

The task of this brief paper is to submit new theories as to the derivations of two words to take the place of derivations which are so absurd that they have long been felt to be untenable. I am proposing new derivations for the words "lament" and "supine."

The ablaut system of dol; del; dol.

Two roots, having different meanings, seem to have identical forms. The first root meaning of this ablaut system is "to fool, deceive," and in Greek, we have e. g., **delear**, bait, deception, used by Homer of the wooden horse, and **dolos**, craftiness, etc. This root is represented in Greek by a fairly long list of words, and in Latin only by dolus and one other, meaning tricky, or trickiness, or deceit.

The second root, having the same ablaut forms, so far as we can determine, means "to grieve." Since there are two roots, looking exactly alike, it can be expected that, to avoid confusion, both the Greek and the Latin would tend to discard one of the two and to use some synoynmous root in its place. The Greek does not seem to use this root in its meaning of "to grieve," but rather extensively employs it in its other meaning. On the other hand, this meaning of the root, namely, "to deceive," is less prevalent in Latin, being represented only by dolus and dolosus, while the other meaning, "to grieve," appears in doleo, dolor, and, I believe, in at least one other word which is based upon another gradation of the ablaut system.

The word 'lament" has been referred to the verb clamare and is supposed to be the shortened form of clamamentum—clamentum. This derivation is so preposterous that I see that self-respecting dictionaries are no longer giving it. In the first place the root clama, in clamare, etc., signifies a loud shout or call, such as applause, or shouts in opposition to a proposal, or the noise or din made by a crowd. The meaning of the root prevents its association with the audible sounds of weeping and mourning, although Orientals and the ancients allowed themselves to give vent to grief and made their grief heard for considerable distance. In the next place, cla— does not lose the initial c. There are some fourteen or more common roots in Latin which begin with the combination cla—-, such as claudo, clavis, etc., in which the c is retained before the l. If c should disappear in clamentum, why does it not disappear in other words which also begin with cla?

My suggestion is that the word lament is based upon the lowest gradation of the ablaut system of dl; del; dol.

The other ablaut system—sup:suep:suop—to sleep, is familiar to all.

The word supine has been regarded as having been based on sub, but this derivation has never been regarded as satisfactory. Why —b— should become —p— is inexplicable, since —b— elsewhere remains —b—, e.g., bobus, etc. The derivation is not plausible when one considers the meaning of the word. Supine means 'lying on one's back" and is the opposite of prone "lying on one's face." How sub plus the abjectival ending—inus can mean this is beyond my powers of comprehension.

My suggestion here is that the word supine is based on the lowest gradation of the ablaut system sup: suep: suop, and originally referred to the position assumed by many people when they are asleep, and hence easily and naturally came to mean "lying on one's back."

EARLY WEAVING IN NEW MEXICO

LANSING B. BLOOM, A. M., School of American Research, Santa Fe.

In some ways the impact of European culture upon that which the first Spaniards found in the Southwest was severe. The Indians were still in the Stone Age, culturally, with no use of metals, of the wheel in any form, or of any domesticated animals except the turkey.

We know, however, from archaeological evidence that the Indians did have weaving frames and that they raised cotton to a limited extent. It was not a difficult transition, therefore, when sheep and wool were introduced to them by Coronado's expedition. By the middle of the seventeenth century Franciscan "masters of doctrine" had already employed Indian women in spinning, weaving mantas, stockings, and other articles, altho in earlier times weaving seems to have been solely men's work.

The Spanish archives at Santa Fe yield scattered data which show that sheep were raised in increasingly large numbers thru the eighteenth century and droves of considerable size, as well as clipped wool, were exported by the annual caravan in the late fall of each year and sold at El Paso del Norte or in the markets of Chihuahua farther south.

Three different governors of New Mexico hampered this source of revenue by decrees against such sale and exporting, but a better policy was initiated by Governor Fernando de la Concha who, in October of 1788, recommended to the viceroy the promoting of commerce and of more extensive weaving—the latter by establishing factories, and by sending in the necessary implements and intelligent operatives. In 1795 the king in Spain granted the people of New Mexico ten years' exemption from customs duties on their products. This was supplemented in 1803 by the establishing of an annual fair in Chihuahua where they might dispose of their exports to advantage. The superior authorities also had decided to send north trained weavers who should instruct artisans in the craft at Santa Fe. A six years' contract was signed in September, 1805, by which two Bazan brothers, members of a weaver's guild in Mexico City, one of them a widower with sons of fourteen and ten, were engaged to travel northwards to Santa Fe, armed with sabers, one musket, two pairs of blunderbusses, one muleteer as companion; and to reside there at least for six years or until they should leave apprentices fully trained in the weaving of cotton, silk, and wool.

This Bazan contract was carried out, in the spring of 1809 Governor Manrique certified to the superior authorities in Mexico City that the apprentices had demonstrated their ability in the presence of two alcaldes of Santa Fe. It has been suggested that the famous Chimayo blankets are a survival of the Bazan instruction, but all that can be definitely stated is that weaving as a native art in New Mexico today has had its origin partly in the prehistoric weaving of the Indians and partly in the art as brought in by the Spaniards.

SYMMETRY IN PUEBLO POTTERY FORMS

KENNETH M. CHAPMAN, M. A., School of American Research, Santa Fe.

In the pottery making of the Pueblo Indians, we find a primitive art that has survived, practically unchanged, from remote antiquity to the present day. Much of the most ancient pottery shows a great skill in its modeling, and that skill, handed down from generation to generation, is still evidenced by many living potters, whose product is an important factor in the economic life of the Pueblo Indians.

Considering the crude means by which Pueblo women still fashion their ware by hand, a high degree of perfection is often reached, not only in the modeling of food bowls and water jars, but also in the making of large storage jars of twenty five or more gallons capacity. The potter does her work upon the ground or floor, squatting before it, and it must be remembered that her view of the form under construction is never directly from the top or side, but is rather a combination of the two views. Since she cannot view its circular contours as circles, nor study its side view directly, with the object of producing bilateral symmetry, she must rely more upon feeling than upon sight. Thus the arms and hands, under wonderful control and working with great speed, play by far the greater part in producing such perfect forms.

An examination of a hundred or more specimens of Pueblo pottery, ranging from very poor to very excellent in form, shows that the variation from true circular contour as viewed from the top, and from exact bilateral symmetry, as viewed from the side, may run from fifteen to as low as one percent of the maximum diameter of the specimen. Pottery with fifteen to five percent variation from mechanical perfection is noticeably misshapen. That between five and three percent is apt to have a handmade look, though many are unable to point out its faults in detail. Pottery with less than three percent variation may easily pass as practically perfect in form. Variations of less than one percent have been found, and it is not surprising that these specimens have led many to believe that the Pueblo Indians are making secret use of the potter's wheel, and that the hand finish has been applied merely to disguise this mechanical process, so that the ware could still command the higher price which hand made products deserve.

A critical examination of a hundred specimens of this remarkably perfect ware produced by the most expert Pueblo potters has shown this suspicion to be entirely unfounded. Tell tale marks of the potter's wheel, and the mechanical perfection of form which results from its use, are hard to obliterate, and some of these would occasionally remain through oversight or carelessness. On the other hand, the slight variations from exact mechanical perfection would be difficult to add to wheel made pottery; indeed the extra work involved might make the process more laborious than to mould the form entirely by hand.

The finest specimens of Pueblo pottery are entirely hand made, and deserve appreciation as wonderful examples of a native product requiring the highest skill and taste.

SCIENTIFIC ADJUSTMENT TO THE USE OF INFERIOR FUELS

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Our present day civilization is founded upon the use of power for transportation, mining, and manufacturing as well as for communication. The greater part of such power is derived from the combustion of fuel.

Wood, a high type of fuel, is little used today because it is so expensive. Anthracite is now a luxury restricted largely to domestic use. High grade bituminous is not as plentiful as it was and it is much more expensive than formerly. Lignite, an inferior fuel, is being used more and more. Low temperature carbonization of lignite with the recovery of valuable by-products is being practiced.

Thanks to scientific adaption, as good fuels have become scarce and more expensive, man has been able to use successfully the more plentiful and less expensive ones, and has thus kept down the cost of power.

We burn in our modern equipment, material once thought incombustible. We clean up dirty coal, eliminating much of its content of ash forming material. Very poor fuel may be burned if powdered and burned mixed with a blast of air.

Petroleum is still our chief source of liquid fuel. During the past two years we have had an oversupply of petroleum, yet scientific research has gone ahead seeking to find how we may prolong the period during which we may have petroleum, by discovering more economical methods of using it.

In Europe the Bergius process gives hope that we may be able to manufacture a liquid fuel from solids. Franz Fischer is reported as having produced a liquid motor fuel called "Synthol" from water gas, which, of course, comes from solid carbonaceous material.

Recent attempts to prepare suitable gaseous fuels from low grade, abundant solids have been successful.

The story of these successes furnishes much food for thought. In one case after another we note that the cream of our natural resources has been skimmed, yet civilization continues to have its cream, or its equivalent, because of the researches of the scientist. How long can this continue? How long can science bolster up our fading natural wealth, so much of which is gone forever when man uses it, in the face of a rapidly increasing population, largely dependent on these materials for its high state of civilization?

THE GENESIS OF THE GREAT LOW-GRADE COPPER DEPOSITS OF THE SOUTHWEST

EDWARD H. WELLS, M. S., New Mexico School of Mines, Socorro.

In a number of copper districts in the southwestern part of the United States tremendously large but low grade ore bodies occur. The most important of these deposits are owned by the Utah Copper Co. in Utah; the Miami Copper Co., the Inspiration Consolidated Copper Co., and the Ray Consolidated Copper Co. in Arizona; the Nevada Consolidated Copper Co., in Nevada; and the Chino division of the Ray Consolidated Copper Company in New Mexico. Of these deposits the largest belongs to the Utah Copper Company. The various properties will eventually yield about 30 billion pounds of copper from over one billion tons of ore averaging about 1.5 per cent in copper.

In shape these deposits vary considerably, but their horizontal dimensions are usually considerably greater than their vertical thickness. The ore is covered with a layer of barren rock. Where it is thin the worthless capping is removed by steam shovels and the ore is subsequently removed in the same manner. At the Arizona properties the capping is too thick to permit its removal, and the ore is mined by underground methods.

The deposition of the primary ores of these deposits was invariably vitally related to an intrusion of monzonite porphyry or similar igneous rock. However, the copper was not necessarily derived from the igneous rocks now exposed to view. In small part the copper may have constituted an accessory element in the molten magmas which solidified to form the monzonite porphyry, but most of it was probably carried upward and deposited to form the primary ore by ascending magmatic or juvenil waters which separated from the parent magma masses deep down in the earth.

The primary mineralizing waters were hot and under high pressure. In addition to copper they contained alkali sulphides, carbon dioxide, sulphur, molybdenum, and silicon. They produced silicification, sericitization, and contact metamorphism in the rocks. They deposited the copper of the primary ore in the minerals chalcopyrite and cupriferous pyrite. The average copper content of the primary ore is 0.3 to 0.7 per cent.

Following the primary mineralization the rocks were subjected to the general processes of weathering, and descending atmospheric waters took the place of the ascending magmatic waters. The pyrite of the primary ore yielded by oxidation sulphuric acid and ferric sulphate which dissolved the copper from the rocks at and near the surface in the form of copper sulphate. The descending solutions decreased in acidity and eventually became alkaline. They deposited their copper chiefly as the copper sulphide, chalcocite, which replaced the primary sulphides. The enriched secondary ore thus produced contains the copper of the primary mineralization plus the copper carried down from the leached rocks above and those removed by erosion.

SELECTED METHODS FOR THE PREPARATION OF PARA-ALKYL PHENOLS

J. H. GRIFFITH, M. A., New Mexico State Teachers College, Silver City.

The preparation of para-alkyl phenols has been the subject of investigation for many years. A survey of the literature discloses the following methods which have been used for this purpose:

(1) Fusion of potassium salt of corresponding sulfonic acid with caustic potash.

(2) Condensation of phenol with chloroformic alkyl esters in presence of anhydrons ferric chloride.

(3) Condensation of unsaturated hydrocarbous with phenol in presence of concentrated sulfuric acid and glacial acetic acid.

(4) Nitration of alkylbenzene, reduction of nitro-compound, diazotization, and decomposition of resulting diazo-compound by boiling the aqueous solution.

(5) Reduction of hydroxy-aromatic aldeluydes and ketones by amalgamated zinc and hydrochloric acid.

(6) Condensation of phenols and alkyl halides in presence of anhydrous ferric chloride.

(7) Condensation of ketones with phenols in presence of glacial acetic and hydrochlores acids.

(8) Action of benzyl chloride or phenol in presence of zinc dust.

(9) Action of alcohols upon phenol in presence of fused zinc chloride. This is the method with which we are chiefly concerned in this paper.

The reaction takes place in a series of steps, the first being a dehydration of the alcohol to form the corresponding olefine. The olefine combines with anhydrous zinc chloride to form an addition product. A condensation between this product and phenol results with the elimination of hydrogen chloride. The hydrolysis of the intermediate product thus formed yields the alkyl-phenol and basic zinc chloride.

It is to be observed that in the condensation the substituent group appropriates the para-position to the hydroxyl group of the phenol. Oxidation of the product affords a method for determining its constitution.

In the Liebmann reaction ethers of the phenols are simultaneously produced. Purification of the alkyl-phenol may be m tionation or by conversion of the phenols into sodium salts and removal of ethers by steam distillation, the phenol then being liberated from its salt and further purified by fractional distillation.

Yields:

P—amylphenol	29.8%
P—butyl-phenol	66.0%
P—isophropyl-phenol	18.0%

The Liebmann method works well in the preparation of the amyl and butyl derivatives. The lower in the series of alcohols we go, the less applicable does the reaction become, until with methyl alcohol no p-cresol is formed. This is probably due to the fact that the lower alcohols have higher dehydration temperatures than their homologues, thus rendering more difficult the formation of the olefine. (Also, the tendency to phenolic ether formation is greater in the case of the lower alcohols.)

Prohyl and ethyl-phenols were prepared by the Olefine--Friedel-Craft Reaction, in which the olefine was condensed on arehydroes ferric chloride and phenol allowed to react with the condensation product, the intermediate compound being then decomposed by water.

Neither amylphenol nor butyl phenol give a color reaction with ferric chloride in aqueous or alcoholic solution. Ethylphenol gives a dirty green coloration with ferric chloride in agueous solution.

THE UTILIZATION OF OXIDE SLAG IN PLASTIC BRONZE MANUFACTURE

PAUL MOZLEY, B. S., High School, Albuquerque

When the railroads substituted tin for zinc in their bearing bronze specifications, the southern producers began experimenting with the lead oxide slags and drosses in the production of this new bronze. A new process was developed that both produced a very pure bronze (free from zinc) and also used up the dross.

This process is carried out in small furnaces shaped like Bessemer converters, and so arranged that a reducing or oxidizing flame may be used in them for melting the metal. The scrap brass, containing a high percentage of zinc, is charged, and for each 1,200 pounds of scrap about 40 pounds of dross is also added. Upon melting with the oxidizing flame, the lead oxide is reduced to lead and the oxygen unites with the alumnium, zinc, iron and tin in the order given. These oxides form a slag and float on top. If the action is carried too far, the lead and copper also are oxidized. Just as the tin begins to oxidize, the flame is changed to a reducing flame. This stops the oxidizing action, but has little effect on the oxides in the slag. Any lead oxide remaining is also reduced so that there is no metallic loss of copper, tin or lead.

This process allows the use of very impure scrap in the production of a very high grade of bronze. In fact, the maximum of 1 per cent impurities allowed in the specifications is very easily met, the resulting metal showing only traces of zinc, aluminum or iron.

SOME FACTORS INFLUENCING THE PERMEABILITY OF SOILS

C. W. BOTKIN, M. A., New Mexico College of Agriculture and Mechanic Arts

A new cause for the infertility of certain lands has been discovered. This cause is impermeability to irrigation water. Such infertile soils are hard, and dry a short distance below the surface, even though water is held on the land for several days. This condition develops in some irrigated soils, which were formerly fertile. The soils are not deficient in plant food but tend to accumulate alkali since the irrigation water evaporates without percolation.

It was thought that the impermeability might be caused by deflocculation of the soil colloids produced by basic exchanges in which sodium and potassium of the irrigation water displaced calcium and magnesium from the soils. The soils were found to be high in calcium and magnesium and the ratio of divalent to monovalent bases in the irrigation and drainage waters were not such as to strongly support this hypothesis.

Sodium chloride, sodium, sulphate, and sodium silicate caused soils to become practically impermeable. Aluminum sulphate, tannic acid, calcium acid-phosphate, magnesium sulphate, manure, and gypsum were found to assist the penetration of water into the impermeable soil. The respective efficiencies of these materials, when one-half of one percent (one per cent of manure) was mixed with a one foot column of the soil of low permeability are represented by 4, 15, 17, 20, 22, and 23; where 36 represents the number of hours in which a one foot column of the untreated soil took in the first six inches of water. The maximum permeability obtainable with aluminum sulphate varied between 0.5 and 1.75 per cent for the four soils studied. Very small amounts of aluminum sulphate caused marked improvement in permeability, indicating that impermeable soils may be profitably improved by treatment with aluminum sulphate. The increased permeability secured by aluminum sulphate was proven to be practically permanent. Aluminum sulphate up to 2 per cent was not toxic when mixed with the soils studied, but became insoluble displacing calcium as sulphate and bicarbonate.

After five months' irrigation test the soils treated with aluminum sulphate had a porosity suggesting that gas might have formed in the soil and subsequently left in solution in the percolating water. The loosening effect of aluminum sulphate may be mechanical similar to the alum baking powder reaction in the making of bread.

The study of permeability is being continued.

A SUPERPOWER SYSTEM FOR THE ELECTRIFICATION OF THE UNITED STATES

P. S. DONNELL, B. S., M. E. E , State University, Albuquerque

Civilizations may be measured by their per capita consumption of energy. At the dawn of history this was small because man was forced to supply all his mechanical needs thru his own individual efforts. Then came the use of draft animals and finally, with the advent of the steam engine of Watt and the hydrauliic turbine of Fourneyron, man, emancipated from much of the drudgery of physical effort, turned himself to invention.

But the ability to use the falling water and extract the energy from the coal was not sufficient, for this energy had to be used where it was produced. Now the ultimate goal thru the electrical transmission of power over great "superpower" systems is that every person in every town and hamlet shall be provided with power to meet all his requirements. To this system would be tied all the immense power plants located at the mouths of the mines in localities where there would be a sufficient supply of condensing water. The term "superpower" is one which has recently been applied to developments which in size, far exceed the present designs.

Before discussing the interconnected superpower system a few of the advantages of electrification may be mentioned.

1. Economy due to:

a. Greater efficiency in energy transformation. By the use of central stations and electric drives the coal consumption per Kw-hr of mechanical energy obtained may be reduced from six pounds to one pound.

b. Reduction in stand-by losses. Opening the electric circuit means the end of the power supply while closing the throttle of an engine does not cause the coal to cease burning under the boiler.

c. Comparative ease and lessened cost of "transporting" energy in the form of electricity. For example, ten per cent of the freight hauled by the railroads is coal for their own consumption. Electrification would eliminate this haulage and release the cars for other purposes.

2. Conservation of our natural resources as a result of the economies obtained thru (1), thru which 182,000,000 tons of the 267,000,000 tons of coal now used annually in the industries, would be saved.

3. Sociological benefits due to elimination of pall of smoke and grime over industrial centers.

Assuming now the benefits of electrification the following may be given as the advantages for the universal extension of this electrification thru a super power transmission system:

1. Economy due to:

a. Greater diversity factor. Two loads with peaks occuring at different hours and connected to the same station will require less total installed capacity than would be required were the loads to be supplied from two separate stations, where each would require sufficient equipment not only to supply its own peaks but to have stand-by equipment for emergencies.

b. Reduction in stand-by losses. The elimination of stand-by losses is most notable in the electrification of railroads where the locomotive is a notoriously inefficient user of coal, considering the hours of firing up, having the fires banked, and when the train is moving down hill.

c. Possibility of much larger and therefore, more efficient generating plants. Generating plants of 600,000 Kw. or more may be constructed at the mouths of mines where the local requirements would call for but a few per cent of this amount. This power would be transmitted for many hundred miles at voltages of 440,000 volts or more.

2. Conservation of the natural resources. Beside the savings noted above a superpower system would enable the country to utilize every available unit of water power. The western states have available six and one-half times their present needs for water power, but this power should be developed immediately and transmitted to the states of the middle west where it would bring about a great saving in the present rate of consumption of coal.

3. Reliability. By means of such an interconnected system any accident or interruption of service would not interfere with the power supply to the industries of tnat district for power would flow into the affected area from all sides to supply the deficiency.

SUN ENGINES

T. T. EYRE, B. S., State University, Albuquerque.

Men has long realized that the chief source of the earth's energy is the sun With the advent of the steam engine many inventors have been enamoured,, or at least attracted, by the idea of converting the radiant energy of the sun into mechanical work. The popular conception is quite often in error on the same problem.

About 60 per cent of the radiant energy of the sun is in the form of light. This, as well as the rest of the radiant energy, in practically all of the schemes, is converted into heat by means of a blackened surface. In some experiments the sun's rays were allowed to strike directly on a blackened surface, but in most there was a concentration of rays by means of mirrors. If power is desired the energy is transformed into heat by means of the blackened surface, then absorbed by a liquid which, upon being vaporized, is made to drive an engine. In cookers and heaters the heat is utilized directly or carried by a liquid medium to the place where it is used .

Mr. C. G. Abbot of the Smithsonian Institution published in 1913 the result of his experiments to determine the amount of energy received from the sun at the surface of the earth. Mr. Abbot's results agree fairly well with those of more careful experimenters. Abbot's value is given as 7.12 B. T. U. per minute per square foot normal to the sun's rays. This is at the outer surface of the earth's atmosphere For this country, i. e., the southwest, a fair estimate of the maximum power that it is possible to develop, even with the most improved equipment, is something like an average of 30 horsepower for continuous operation per acre of land surface. When the statement is made that there is energy coming from the sun to the earth equivalent to 7,300 horsepower per acre it can easily be appreciated that the lay mind is often mislead.

To equip an acre of land to catch the sun's energy and to install suitable and efficient engines to convert this energy into work would require an extremely large investment per horsepower. Not only that, but with the vast and efficient engines to convert this energy into work, would require an extremely large investment per horsepower. Not only that, but with the vast amount of coal that exists in the southwest it is beyond the limit of probability that, with our present knowledge, we will ever utilize the sun's energy directly for power. A summary of most of the published results of experiments with sun engines is contained in the report for 1915 of the Smithsonian Institution.

The question of sun engines has so often been brought to the attention of the speaker and his lack of exact information was so great that about a year ago he started an experiment to ascertain some of the facts concerning the matter. This is not a report on that experiment, as I have had opportunity to do only a small amount on that subject. The scale of the experiment is quite small, only 6.78 square feet of sadiation normal to the sun's rays are captured. The highest amount converted so far in a single experiment is about 3.5 B. T. U. per square foot normal to the sun's rays This is about half that coming to the outer atmosphere, and is about as large an amount converted as that reported by previous experimenters.

The Smithsonian Report, referred to above, gives the results of quite an elaborate experiment performed in Egypt. The results given show that the amount of energy converted decreased quite markedly with the increase in relative humidity of the air. I have not been able to check these results in so far as the humidity at the surface of the earth is concerned but I have reason to believe that humidity is a very material factor in the amount of energy intercepted by the atmosphere. I have noticed that even the most filmy and light cloud will cause a very decided decrease in the energy received. To any one, in this country, who has watched the clouds form and disappear it is evident that there are strata of air that are often quite humid, and as the sun's rays must pass htru these strata, where the relative humidity is high, it is evident that the relative humidity of the air above is of more importance than the humidity at the ground, and also that the humidity above has no direct relation to the humidity at the ground.

In general, the results that I have obtained for different days are quite varied and I can only account for the wide variation on the assumption that the relative humidity of the upper air is variable and independent of the humidity at the ground. I have also been impressed with the number of days we have that are not absolutely clear. The weather reports do not tell the story at all. While this investigation has been interesting, I feel that the utilization of the sun's energy for power purposes is a problem of little practical importance at present.

DISTORTION IN VACUUM TUBE AMPLIFIERS

R. W. GODDARD, B. S., New Mexico College of Agriculture and Mechanic Arts.

Amplifiers are called upon to reproduce with increased energy content, changes in magnitude of an electric current. The output current is usually a true alternating current. The output current while unidirectional may be considered as composed of a direct space current plus the useful alternating current.

For distortionless amplification it is essential the following conditions obtain:

Input impedance independent of frequency.
Output impedance independent of frequency.
Internal impedance independent of frequency.
Input impedance independent of current amplitude.
Input impedance independent of current amplitude.
Output impedance independent of current amplitude.
Internal impedance independent of current amplitude.
Efficiency of device independent of current amplitude.
Efficiency of device independent of current frequency.
Amplification constant independent of current amplitude.

Amplifiers as at present constructed are made up of vacuum tubes and associated circuits. Most modern vacuum tubes fulfill the required conditions within limits. The associated circuits may be classified in accordance with the work they perform as grid input, filament heating, and plate output circuits. The grid input circuit utilizes the potential of a resistance, reactance or transformer secondary to produce valve action of the grid in the plate circuit. Each type of circuit has its advantages and disadvantages as regards distortion. The filament heating circuit has little or no effect on distortion. The plate circuit includes the tube, the source of energy and a load. This load may be the grid circuit to another tube or a sound producing instrument. The amount of distortion in this circuit depends largely upon the character of this load. If it is the grid circuit of another tube it may be treated as indicated above after proper care is taken of the space cursent component. If a sound producing instrument is present distortion is inevitable. It may be reduced by many means. The "push-pull" circuit is often used for this purpose.

Theoretically it is nearly impossible to get distortionless amplification. Practically, the causes of distortion may be reduced by various means so as to give very nearly perfect reproduction. Certain characteristics of the human ear to supply deficiencies and correct inaccuracies greatly aid in overcoming the short comings of the vacuum tube amplifier. With greater refinements in details of apparatus, better results may be expected. It is truly marvelous the uses to which amplifiers have been applied with great success in the last few years.

LONG RANGE WEATHER FORECASTING

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Weather forecasting has been a matter of almost universal interest ever since the days when the ancient Babylonians based their predictions on the place of the constellations in the heavens. Accuracy of prediction, however, has been as lacking in our modern times as it was among the

Greeks, who coined a new word, meaning "a mean babbling about sublime things" to express their opinion of all weather forecasting.

Interest has again been revived in this old subject by the work of Mr. H. H. Clayton of the meteorological service of Argentina. Mr. Clayton uses as the basis for his predictions the variations in the solar constant. By comparing data taken at widely separated places on the earth's surface following changes in the radition received from the sun he has reached the following conclusions.

1. Every increase in solar radiation lowers the pressure within the tropics and increases the pressure in latitudes 40′ to 60′ whether within the crease in solar radiation be for a few days, for months, or for years.
2. The fall in pressure with increased radiation occurs near the equator at every season; but the air which presses outward to higher latitudes as a result of this fall increaes the pressure over the continents in the winter, and over the oceans in the summer, in other words, at each season it goes to the regions which are coldest for the latitude.
3. With increased solar radiation the pressure falls over the central areas of the continental masses in summer.
4. The permanent low pressure areas near Iceland and the Aleutian Islands are intensified with increased solar radiation.
5. With solar radiation below normal the effects for different regions for the same time of year are the reverse of those when these is an equivalent excess of solar radiation.
6. There is a lag in the solar effect near the center of radiation proportiveral to the duration of the solar change. If the duration of an increased solar radiation is no greater than a day the lag is only a few hours, if the high or low solar radiation continues for severl days the lag may amount to two or thsee days, if the period is near the length of a year, the lag is nearly a month, and if the period of change is eleven years or the sun spot period, the lag may be many months or a year.

The effect of increasing solar radiation on the temperature was not so marked as on the pressure. In the part of the world from 20 north to 20′ south and from 40′ to 60′ north and south, which embraces the larger part of the world, the surface temperature was in general lower at the time of greatest solar radiation. At higher latitudes the temperature increased with increased solar radiation.

The effect on rainfall was still more difficult to determine with accuracy on account of the local conditions which influence rainfall, but on the whole, these was an increase of rainfall in the low pressure belts and a decreased rainfall in the high pressure belts.

It would be a little premature to announce any definite rules for long range weather prediction but in the work of Mr. Clayton it may be that we have the nucleus of a future system that will be sucessful.

ADVANCES IN THE TREATMENT OF TUBERCULOSIS

LEROY S. PETERS, M. D., Albuquerque.

'About all that was done in the treatment of tuberculosis, after the discovery of the tubercle bacillus, was to advise a sanatorium routine which consisted chiefly of rest, fresh air, good food and a change of climate, if this were possible. This was practiced religiously up to the time that tuberculin was introduced by Koch in 1890. This was considered a cure for tuberculosis, based on Koch's statement, but the results were very disappointing, and today it is used but little except in the surgical types of the disease.

Knowing that rest was the principal factor for getting people well, various attempts have been made to immobilize the lung, thus putting it at rest also. As far back as 1820 Carson of Edinborough attempted to compress a lung by blowing air through a goose quill into the pleural space. This, howeves, was doomed to failure, due to infection. Forlanini of Italy and J. B. Murphy of Chicago reported their work in 1898, working independently of one another. They had devised a machine and allowed air to flow into the pleural space, and compressed the lung. The work was made popular in this country by Mary Laphan's report in 1912 at the National Association. Since then we have been using this method in the treatment of unilateral cases of tuberculosis. Many times adhesions are present which interfere with the compression of the lung. An operation has been devised to overcome this, called extra pleural thoracoplasty. This consists in a resection of the ribs from the 10th or 11th through the first, taking out from six inches of the 10th or 11th to about one inch of the first. This causes the chest wall to cave in and compress the lung, thus putting it at rest. These two methods of surgery offer the best treatment so far known in pulmonary tuberculosis; but, owing to the fact that a patient must have a comparatively good lung on the opposite side, the number who are suitable for this form of compression is very limited.

INTELLIGENCE TESTS AND SCHOOL PROGRESS

B. F. HAUGHT, Ph. D., State University of New Mexico, Albuquerque

The Army Alpha tests were given to 325 freshmen soon after they entered the State University. Of this number 297 carried 12 or more hours and remained for at least one semester. The problem investigated shows a comparison of the academic grades and the intelligence test scores. Grades are used for two semesters unless the student withdrew at the end of the first.

The students were grouped in deciles according to the scores made on the intelligence tests and the total number of hours of A, B, C, D, and F computed for each decile, The data tabulated and graphed, several certain conclusions, as follows:

1. The number of A's and B's decrease rapidly from the higher to the lower deciles.
2. The number of D's and F's increase rapidly from the higher to the lower deciles.
3. The number of C's remains fairly constant. In other words, the number of C's is independent of intelligence.
4. The number of D's and F's made by the lower thirty per cent is so great tnat it would require approximately six years to complete enough hours to graduate and then sufficient hours of A, B, and C grade in any one subject would not have been obtained for a major.
5. The number of D's increase very rapidly in going from the fifth to the sixth decile. This probably is due to the tendency to give students on the border between failing and passing the benefit of the doubt. This conclusion is further evidenced by the fact that the number of F's decrease in the sixth decile and then increase abruptly.
6. The number of D's and F's remains very constant in the three lower deciles. In other words a student in the lower decile makes about the same number of these marks as do those in each of the two deciles above.

FACULTY CONTROL OF HIGH SCHOOL ATHLETICS

E. W. LIGHTON, B. S., High School, Albuquerque.

The problems arising during the faculty control of high school athletics fall into two classes:

1. Those dealing with the sale of season tickets and handling the finances of the athletic association.
2. Those that arise before and during an athletic event.

The sale of season tickets can be readily increased by the organization of student teams and by the use of inspirational talks.

Care of the athletic equipment and scheduling of games should be the work of the coach. No game should even be invited without the sanction of the athletic manager.

At the end of every season the manager's books should be turned over to the principal promptly for audit by him or by the proper persons.

There is a variety of problems that arise before and during the conduct of any athletic event. Many of these problems, such as the unpleasantness caused by the person who makes a disturbance at the gate, the necessity of clearing a field or hall before an event, can be greatly helped in solution if the person having to deal with them will become a deputy sheriff. The organization of an adequate student police corps is also a very material help.

From the point of view of the school authorities any faculty member to whom is entrusted the management of the school's athletic finances should be considered by the authorities of the school as performing a service quite on a par with that which he performs in the class room, and should be given the whole hearted support which the position so well merits. Under no circumstances should this duty be assigned to anyone who will regard it as an onerous task for in so assigning it the authorities allow to be put before the students an example of laziness and inefficiency which cannot be overcome by the other members of the staff no matter how carefully their class room conduct may be regulated. By a thoro-going, business-like conduct of the financial end of athletics, the school authorities set before the students an example which they will more or less unconsciously take as part of their make-up and accept such management as being desirable in the conduct of their own affairs.

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